

HABITAT, GEOLOGIC, AND SOIL CHARACTERISTICS OF SHASTA SNOW-WREATH (*NEVIUSIA CLIFTONII*) POPULATIONS

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ABSTRACT

Following our recent discovery of seven new Shasta snow-wreath populations during 2003 and 2004, we conducted a GIS analysis using location data from the new sites, and from all previously known sites to determine the habitat, geologic, and soil characteristics of each Shasta snow-wreath population location. Previously considered a species only associated with limestone substrates, our new information shows that 47% of all known Shasta snow-wreath sites occur on non-limestone geologic or soil types.

Key Words: Shasta snow-wreath, *Neviusia cliftonii*, limestone, Shasta Lake, geology, soil, Rosaceae.

Shasta snow-wreath (*Neviusia cliftonii* Shevock, Ertter & Taylor) is a recently discovered shrub of the Rosaceae: Kerrieae. It is endemic to northern California in the vicinity of Shasta Lake, Shasta County. The environmental conditions and geographic isolation of the species suggest that it is one of the remnant taxa of an old, formerly more widespread genus (Shevock et al. 1992). A fossil occurrence of a closely related plant in a Pacific Northwest Eocene flora supports this hypothesis (DeVore et al. 2004).

The species' type locality and the subsequent two populations discovered were on limestone substrates (Shevock et al. 1992; Taylor 1992; Shevock 1992). Shasta snow-wreath was therefore thought to represent a limestone endemic species, and is described in *The Jepson Manual* (Hickman 1993) as a species occurring in habitats associated with limestone rock formations. Its closest relative, *Neviusia alabamensis* Gray, of the southeastern U.S., commonly occurs on limestone, but is also found on sandstone and shale substrates (Yocom and Little 1975; Patrick et al. 1995). Subsequent observations of Shasta snow-wreath in the Shasta Lake area demonstrate that it too occurs on soils of non-carbonate origin.

PREVIOUSLY KNOWN OCCURRENCES

The California Department of Fish and Game's California Natural Diversity Database (CNDDDB) and the California Native Plant Society Inventory of Rare and Endangered Plants contain records of ten known Shasta snow-

wreath locations (excluding the new locations discussed in this article). Habitat information reported for these ten previously known locations indicates that eight (80%) occur within habitats associated with limestone rock formations. Most of those first ten Shasta snow-wreath discoveries were made during the year following the initial type locality discovery and publication of the species name, when efforts to find additional Shasta snow-wreath occurrences focused on other limestone areas near Shasta Lake as potentially suitable habitat (Shevock 1992).

NEW OCCURRENCES

During field investigations in 2003 and 2004, North State Resources, Inc. personnel discovered seven new Shasta snow-wreath locations in the vicinity of Shasta Lake (Lindstrand and Nelson 2004) (Fig. 1). Specifically, these discoveries occurred during vegetation and habitat mapping conducted along the margins of Shasta Lake, and were opportunistic discoveries, rather than results of a systematic plant survey. These new locations occur primarily along drainages in dense, shady montane hardwood-conifer and ponderosa pine forests, but also in open foothill pine-blue oak woodland habitat. The new snow-wreath populations range in size and aerial extent from several plants in a relatively small area, to extensive stands consisting of thousands of plants blanketing both sides of a stream corridor for at least a quarter mile. Of these seven new occurrences, only one is associated with limestone substrate.

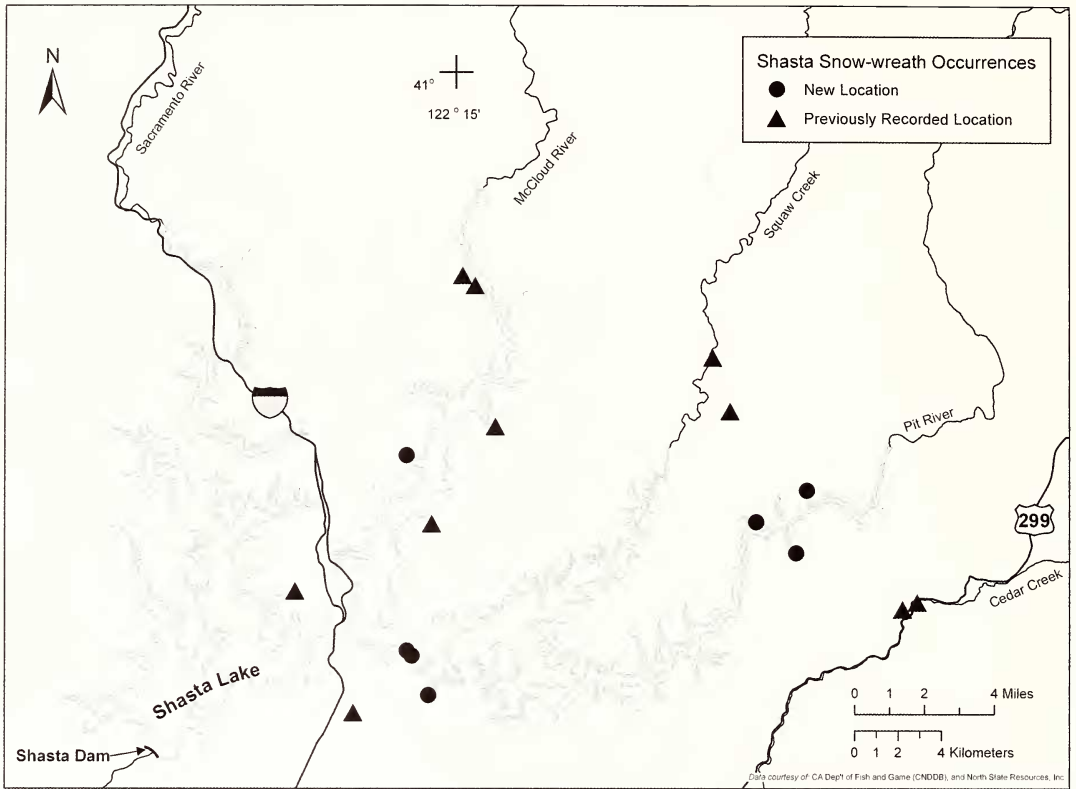


FIG. 1. Known Shasta snow-wreath occurrences and distribution. Shasta County, California.

ANALYSIS OF GEOLOGY AND SOIL CHARACTERISTICS

A geographic information system (GIS) analysis of all known Shasta snow-wreath occurrences was performed in order to quantify the distribution of occurrences on carbonate and non-carbonate substrates. All ten previously documented occurrences listed in the CNDDDB were extracted to a GIS shapefile as point data. We then converted our seven new occurrences to point data and added that data to the shapefile. The shapefile was intersected with a digital geologic map of the Shasta Lake area (USDA Forest Service 2004), and the distribution of Shasta snow-wreath occurrences by geologic map unit and general geologic type was determined. The Shasta snow-wreath occurrence points were then intersected with the digital Order 3 soil survey of the area (USDA Forest Service 1983), and the distribution of Shasta snow-wreath occurrences by Order 3 soil map unit was determined.

Each new population was also field-checked for evidence of unmapped limestone outcrops, since there are occasional exposed limestone inclusions within the Shasta Lake area that are too small to be included in landscape-scale geology or soil maps.

RESULTS

Nine of the 17 known Shasta snow-wreath occurrences intersected the mapped extent of limestone bedrock and are found within limestone geologic types (Table 1). The remaining eight occurrences are found within primarily metavolcanic and metasedimentary geologic types.

Three of the 17 known Shasta snow-wreath occurrences intersected the mapped extent of Order 3 soil map units with limestone parent material (Table 2). However, six additional occurrences are located immediately adjacent to, or downstream of limestone outcrops; where there is a high likelihood that colluvial or fluvially transported limestone substrate is present; or are located within limestone inclusions occurring within the Order 3 soil mapping unit. Collectively, nine Shasta snow-wreath occurrences are either located within, or are immediately adjacent to soil types containing limestone parent material. The remaining eight occurrences are found within primarily metasedimentary/metavolcanic Order 3 soil map units.

DISCUSSION

Of our seven new Shasta snow-wreath discovery locations, only one intersected the mapped

TABLE 1. DISTRIBUTION OF *NEVUSIA CLIFTONII* OCCURRENCES BY GEOLOGIC TYPE.¹—Also contains limestone fragments and strata.

Geologic map unit	Formation	Rock type	Age	No. Shasta snow-wreath occurrences
Cb	Baird	Metasedimentary	Carboniferous	2
Cbmv	Baird	Metavolcanic	Carboniferous	1
Dc	Copley Greenstone	Metavolcanic	Devonian	1
Pmd	Quartz Diorite – Dikes	Intrusive	Permian	1
Pmml	McCloud Limestone	Carbonaceous	Permian	1
Pmn	Nosoni	Metasedimentary/ metavolcanic	Permian	1
Trh	Hosselkus Limestone	Carbonaceous	Triassic	4
Trm	Modin	Metavolcanic ¹	Triassic	3
Trp	Pit	Metasedimentary	Triassic	3

TABLE 2. DISTRIBUTION OF *NEVUSIA CLIFTONII* OCCURRENCES BY ORDER 3 SOIL TYPE.

Order 3 soil map unit	Dominant soil type	Dominant parent material	No. Shasta snow-wreath occurrences
102	Holland Family	Metasedimentary/metavolcanic	1
105	Holland Family	Metasedimentary/metavolcanic	5
117	Holland Family, deep	Metasedimentary/metavolcanic	1
178	Marpa Family	Metasedimentary/metavolcanic	1
179	Marpa Family	Metasedimentary/metavolcanic	1
180	Marpa Family	Metasedimentary/metavolcanic	1
183	Marpa Family	Metasedimentary/metavolcanic	1
195	Millsholm Family	Sedimentary	1
204	Neuns Family	Metasedimentary/metavolcanic	1
222	Neuns Family	Metasedimentary/metavolcanic	1
250	Rock Outcrop, limestone	Limestone	3

extent of limestone bedrock. With the addition of these seven new sites, there are now seventeen documented Shasta snow-wreath occurrences. Following our GIS analysis of the geologic and soil characteristics at each location, nine of the 17 Shasta snow-wreath occurrences intersect the mapped extent of limestone bedrock, or occur immediately adjacent to or downstream of limestone outcrops. The remaining eight locations, including four of the five most extensive populations, are found in non-limestone habitats.

These seven new Shasta snow-wreath discoveries have nearly doubled the number of known occurrences. Additionally, the geology and soil type analysis of these locations show that nearly one-half (47%) of the known species locations occur in habitats not associated with limestone rock formations nor soils formed from limestone parent material.

Though these new occurrences have filled some gaps in the known distribution, they are within the previously recorded species range. Most of the documented Shasta snow-wreath occurrences are located within the eastern half of the Shasta Lake region in the Pit River, Squaw Creek, and McCloud River drainages. One occurrence lies within the western half of the Shasta Lake region in the Sacramento River drainage. Given our analysis of the geologic and edaphic character-

istics at the known Shasta snow-wreath sites, the previous assumptions regarding the species geologic and edaphic associations, and the fairly limited geographic extent of previous survey efforts, only a small fraction of potential habitat for this species has been surveyed, and it is highly likely that additional populations occur.

The conservation implications from these new Shasta snow-wreath discoveries may be described as two-fold. These new populations, in terms of both numbers of known occurrences and more widespread geologic/edaphic associations, show that the species may not be as rare or narrowly distributed as initially thought. However, six of the known populations have already been at least partially flooded by the creation of Shasta Lake. Additionally, these new discoveries also show that the species is still likely a narrow endemic to the Shasta Lake region. Endemism within this region is already fairly well documented by the presence of several endemic plant and wildlife species including Shasta cupatory (*Ageratina shastensis*), Shasta salamander (*Hydromantes shastae*), Shasta sideband snail (*Monadenia troglodytes troglodytes*), and Wintu sideband snail (*M.t. wintu*), and is likely a function of geologic and climatic factors. The geology of this region is considered ancient, particularly relative to surrounding regions, and was not affected by

glaciation, nor was overlain by volcanic material. Additionally, this region lies within an area of high annual precipitation at relatively low elevations, producing a combination of mesic conditions and mild temperatures. These geologic and climatic factors in the Shasta Lake region result in conditions favorable for a diverse flora and fauna, including several endemic species.

The boundaries of Shasta snow-wreath's geographic and elevational range have yet to be determined. It is clear from our analysis of geologic and edaphic characteristics at the known snow-wreath population sites that non-limestone substrates cannot be excluded as suitable habitat, and that field inventories for Shasta snow-wreath within the species known distribution should include a wider range of substrates, aspects, and vegetation types than was thought suitable for the species.

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